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The Domed Canopy in Byzantine Church Design

by Jelena Bogdanović, *appearing in* Volume 37

The Church of Hagia Sophia in Constantinople (modern Istanbul, Turkey) by Anthemius of Tralles and Isidorus of Miletus, 532-537. Photo: Getty Images/Tetra Images

The famous sixth-century Constantinopolitan cathedral of Hagia Sophia epitomized the might of the Byzantine Empire. The empire thrived as a successor to the Roman Empire in the Eastern Mediterranean for more than a millennium, from about 300 to 1450. Built in only five years, from 532 to 537, during the reign of Emperor Justinian, this massive domed structure remained closely associated with the Byzantine Empire long after the realm's historical demise.

Procopius of Caesarea, official historian at Emperor Justinian's court, recorded that the church was designed to create the impression that it does "not rest upon solid masonry, but [covers] the space with its golden dome suspended from heaven." The ceiling is "overlaid with pure gold, which adds glory to the beauty, yet the light reflected from the stones prevails, shining out in rivalry with the gold."

Today, we usually associate Byzantine architecture with its dome, as a generic but highly evocative and culturally invested architectural form. Prevailing opinion is that reflective golden mosaics in the interiors of the domes are the major reason for the dazzling atmospheric light of Byzantine churches. Yet the architecture of the domed canopy, inseparable from the immaterial space it frames, was the overall guiding idea for Byzantine churches. The holistic design also contributed to the style's plasticity, the quality of being adaptable to different contexts and locations.

A church built 1,500 years later and thousands of miles away illustrates both the centrality of the dome and the way architectural forms and styles can migrate to places seemingly entirely disconnected from their origin. The Church of All Saints in Stuart, Iowa, raises several critical questions about the essence and relevance of Byzantine imperial architecture. The Irish Catholic community built this church between 1908 and 1910. The parishioners, desiring a beautiful church, constructed the building in a Neo-Byzantine style, looking at San Marco's Basilica in Venice for inspiration.

In 1995, an arsonist set a fire within the altar dedicated to the Mother of God. He wanted "to take the heart and soul of a community," as one person involved in the restoration put it. Unable to meet restoration costs, the parish sold the building to the Project Restore Foundation, which then led a highly successful community-supported restoration project.

The architects looked at historical precedents in Byzantine architecture and focused on the most critical part of the structure and its design: the massive dome. The crowning moment of the restoration project was when the dome, lifted by a massive crane, was placed onto the top of the structure.

Now restored as a center for religious tolerance, the All Saints Center for Culture and the Arts still carries the "soul" of Byzantine architecture within the community: its massive dome painted in Midwestern sky blue, reflecting natural light and evoking the heavenly realm. The building does not function as a church anymore. Yet the Center continues to respond to the needs of the community and is the preferred place for local family gatherings, wedding ceremonies, concerts, conferences, and school events.

Critical Questions

The All Saints Center is not a mere copy of any specific Byzantine church, even though it is inspired by San Marco. San Marco is already a kind of hybrid, built outside the major Byzantine domain in an effort to compete with the now-lost church of the Holy Apostles in Constantinople, once the major burial place of Byzantine Emperors. This iconic yet non-imitative quality is inherent to the Byzantine style and complicates a simplistic interpretation of it as Roman imperial architecture that has been Christianized.

Just as the Byzantine Empire was not a mere avatar of its precursor in the West, the Roman Empire, neither were its domed churches mere copies of Roman imperial structures. The treatment of light perhaps best illustrates the major design differences between the Roman Pantheon, as the sacred space par excellence of the Roman Empire, and the Hagia Sophia, as the most sacred architectural counterpart of the Byzantine Empire.

The oculus of the massive dome of the Pantheon was an aperture that channeled the shaft of light into the vast interior below, even as the dome itself remained mostly in darkness. For the Hagia Sophia, the solid Byzantine dome scooped the light from multiple sources in the lower zones of the interior and returned it back toward the dome apex, literally highlighting the dome's inner shell. But is it the form, materiality, or the particularly articulated presence of light that defines the essential qualities of the Byzantine church?

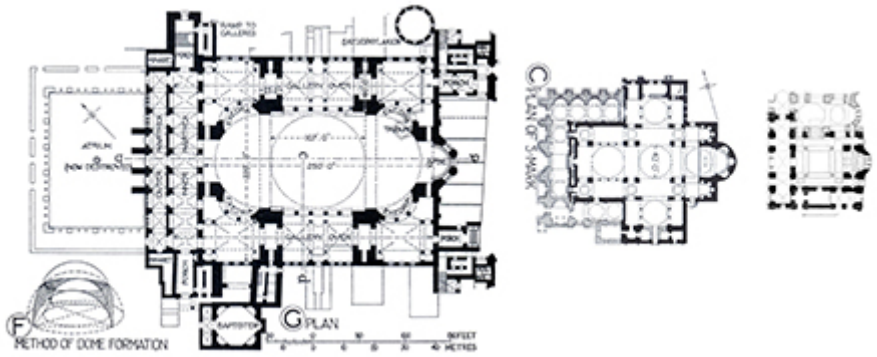
The radiance of the space of the church of Hagia Sophia was the major concept behind its design. Procopius reported: "Indeed one might say that its interior is not illuminated from without by the sun, but that the radiance comes into being within it, such an abundance of light bathes this shrine." The porphyry pillars, recurrently used for Byzantine imperial churches, supported the luminous dome as if suspended from heaven. The effect was especially vivid during evening services when the light of the candles and chandeliers reflected upon gold and silver mosaics and church furnishings.

The famous quote attributed to the envoys of Russian prince Vladimir (d. 1015) recreates the experience of the Hagia Sophia: "We knew not whether we were in heaven or on earth. For on earth there is no such splendor or such beauty, and we are at a loss to describe it. We only know that God dwells there among men, and their service is fairer than the ceremonies of other nations."

When twenty-five-year-old Queen Eleanor of Aquitaine visited Constantinople in 1147, she described the church as resting "lightly as a cloud upon pillars of porphyry." The canopied form and its materiality in porphyry and light point to biblical references of the pillars of light and fire and the revelation of God (Exodus 13:21-22; Psalm 99:7).

The powerful spatial image of the luminous dome on massive pillars in a way recreated a cloud of light and the divine presence or "Glory of God," as described in Revelation 10:1. It referenced the presence of God that filled the tabernacle, or tent of meeting, where God met with his people during the desert wandering, and the Holy of Holies in the Temple of Jerusalem (Exodus 40:34; Ezekial 43:4).

The Byzantine church domes dazzled observers with splendor that represented or replicated the primordial tent, the heavenly house, the promise to liberate all of creation from its burdens, the union of heaven and earth, and a promise to the faithful of a heavenly Jerusalem filled with the divine presence. "Him that overcometh will I make a pillar in the temple of my God, and he shall go no more out: and I will write upon him the name of my God, and the name of the city of my God, which is new Jerusalem, which cometh down out of heaven from my God: and I will write upon him my new name [i.e. Christ]" (Revelation 3:12).



Plan comparison, left to right: Hagia Sophia, Constantinople; San Marco, Venice; Pantocrator Monastery, Constantinople. Images: wikimedia.org

Form and Iconicity

The form of Byzantine churches—the complex materiality of their solids, the immateriality of the domes' light-filled voids, and the meanings related to these—emerges as critical for their iconicity. Their form can be understood as a relation between the iconic dome and its evocative representation of the heavenly realm. The highly sophisticated architectural treatment of light as a "cloud of light" signifies to the faithful the divine presence and evokes biblical references.

The domed core of the Hagia Sophia points to refined modeling of both the physical envelope, which consists of four clustered piers merged with the dome via spherical triangular *pendentives*, and the interior volume wrapped in light and shaped by this envelope, which takes the descriptive form of the pillar of cloud Eleanor of Aquitaine described.

Such an iconic *parti* dematerialized the physical matter of the building and gave form to immaterial light, treating the material and immaterial aspects as inseparable even in the construction process. The four vertical supports, horizontally connected by middle-zone arches and crowned by the dome, simultaneously constituted the three-dimensional structural core of the church and defined the interior space.

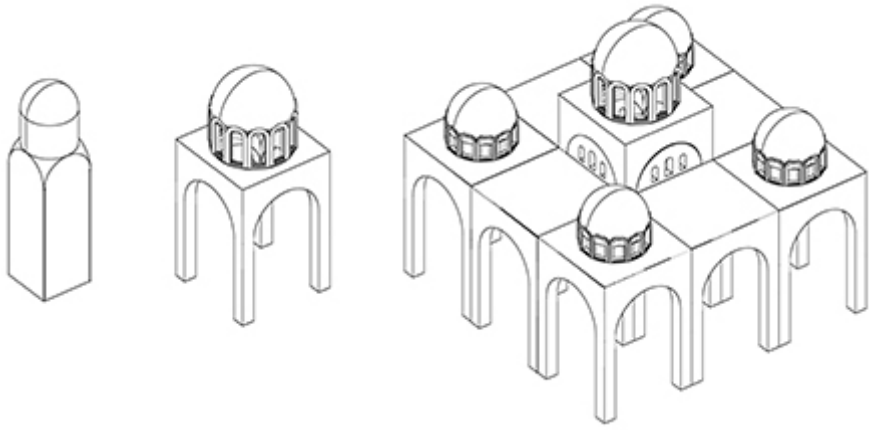
These unique design features point to the designers' more plastic treatment of architectural modeling. They took into consideration the three-dimensional *parti* as a holistic structural unit rather than understanding the core and dome as a simple box capped with a lid.

The Byzantine structures that considered the domed core as a holistic unit and the neo-Byzantine structures that re-employed the idea by placing the domical roof on top of the superstructure belong to the same architectural taxonomy. The interiors of these structures are where the differences in design and the search for a holistic approach become evident.

While it was by no means the first or only structure to be defined by a domed canopied core on both the exterior and interior, Hagia Sophia was the largest and most prominent, and it became an icon of the Byzantine Empire and its architecture. The massive structure was never repeated nor would it have been feasible to do so. Instead the church inspired a typology of a centralized structure that would be used to design and build churches of various sizes and complexities.

Byzantine Modeling

Based on the study of hundreds of Byzantine churches, I propose that the Byzantine architects used plastic, three-dimensional modeling to visualize church space by setting the canopy-like domed core on a modular grid. This system, at its most essential level, consisted of a dome centered inside a nine-square grid. By employing plastic treatment of the church space, additional elements can be added to this plan; for example, side chapels, narthexes, and ambulatories.



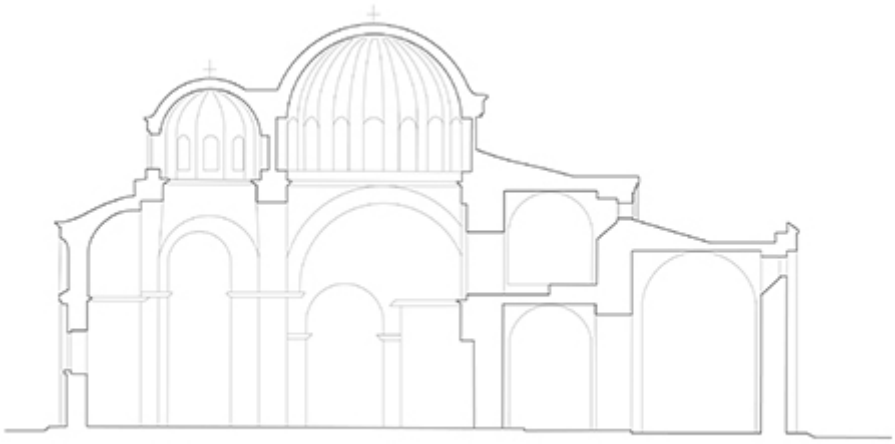
Process from volume, to canopy, to nine-square design based on canopied parti in Byzantine churches. Image: Alex Blum

This design system was also subject to exceptions and alterations, the plasticity of which resulted in various solutions. These features allow for both a recognizable expression of three-dimensionality within Byzantine churches and their adaptability to different contexts.

For example, San Marco's in Venice offers a very systematic adoption of Byzantine church design based on the three-dimensional canopy and the nine-square grid. The current structure is the third church on the site, built between approximately 1063 and 1090, with some later additions. Five independent structural bays arranged in a Greek cross form the core of the church, with a narthex on the west side and a large apse on the east, and a few spatial modifications connect the church to the nearby Palazzo Ducale. The domed cores also have a clear hierarchy: The largest dome is in the center and the smaller domes are situated off of the building's primary east-west axis.

San Marco, Venice, Italy. The oblique view shows the massive shoulder arches in brick. Photo: Jacob Halun

The imperial Pantokrator monastery in Constantinople, built between 1118 and 1136, shows how flexible this system could be. Two churches use the typical nine-square grid plan with a canopy core at their centers, with one having a relatively flat cylindrical drum and elliptical dome, potentially a post-Byzantine reconstruction.



Section of the Church of Archangel Michael in the Pantokrator Monastery. Image: Heidi Reburn

The most peculiar experimentation had to be implemented when an additional chapel, dedicated to Archangel Michael, was constructed in the narrow space between two churches. It consists of two domed canopies merged together as if they were architectural conjoined twins. Elliptical domes of different sizes share a structural arch on their adjacent edge. Despite the unusual conditions, this unique double arch manages to fully explore the plasticity of Byzantine architecture while maintaining its iconicity and interiority.

The Church of Archangel Michael with two intersecting domes. Photo: Vladimir Božinović

The designers also experimented with the modeling of light and the notion of the radiant space by focusing on the interior modeling of the surface of the two domes. The western dome, actually the largest in the entire complex, is sixteen-sided with internal ribbing, while the eastern one is twelve-sided with internal scalloping. Today preserved without the original surface treatment—which would have consisted of elaborate mosaics or fresco paintings as seen elsewhere in Byzantine-rite churches—these domes reveal advanced modeling of atmospheric light through architecture.

The Cloud of Light

Prevailing opinion is that the reflective golden mosaics are the major contributors to the dazzling atmospheric light of Byzantine churches. However, recent parametric research shows that the orientation of the windows, the angular cutting of the windowsills, the geometry of the dome and in particular its internal ribbing or scalloping, also significantly increase the effect of the "cloud of light." These all scoop and direct light back toward the apex of the dome. Such a systemic design represents the very essence of the glorious space and the heavenly Jerusalem.

This principle is evident in the main church in the Studenica monastery in Serbia, set as a domed-canopied cross in the circle of the monastic compound. The construction of the elegantly proportioned church can be dated to 1183-1209. The single-nave church with a domed-canopied square naos combines two types to form what is known as an atrophied Greek-cross church. In such churches, the lateral arms of the cross are reduced to narrow barrel vaults, essentially becoming massive arches that project from structural piers. These piers also support transversal arches that define the square-base domed core of the church.

Additionally, the Studenica church elucidates how the core canopy grew proportionally taller throughout the course of its historical development. Here, like in the Archangel church of the Pantokrator monastery, the domical calotte is internally scalloped and contributes to the modeling of light inside the structure.

The acoustically sound and bright interior of this church is complemented by an equally radiant exterior envelope, because the church was built of ashlars of the finest marble—in some cases up to fifty centimeters thick.

The edifice is crowned by an elevated, canopy-like masonry dome. Its drum is painted red and articulated by white marble colonnettes and carries a calotte sheathed in shiny silver-lustered lead.

Usually, under ideal conditions, construction in marble would grant the structure longevity, aiming for eternity. Sunlight and moonlight cause the white polished marble of the church to glitter, further confirming the sophisticated use of light to create this effect of radiance and evoke the supreme beauty that gives light and is itself represented through light.

The Studenica church elaborated on the concept of the ideal church as the heavenly Jerusalem and is dedicated to the Mother of God, who is the embodiment of the Church and the first resident of the heavenly Jerusalem. The central church, with its twelve-sided canopied dome, symbolizes the heavenly microcosm. It originally housed a sacred relic of the holy cross and a miracle-working image of the Mother of God, thereby advancing its associations with the heavenly Jerusalem on multiple levels.

For the faithful, the biblical New Jerusalem frees all creation from its numerous bondages. This aspiration resonates highly with the design principles used in the Studenica and other Byzantine-rite churches that aimed to dematerialize matter, materialize light, and actualize spiritual experience. We often recognize these features today through the experiential, emphatic, aesthetic, transcendental, and supra-spatial qualities of architecture.

The Crucial Dome

The massive domed structure of the Hagia Sophia required the expertise of the mathematician Anthemius of Tralles and the physicist Isidore of Miletus. There are few first-person accounts of architectural practices after the construction of the Hagia Sophia.

This has led to a belief that in Byzantium architects had limited roles as designers and thinkers and that master builders, who essentially controlled the construction on site, had a more pronounced role. Recent comparative analyses of textual sources, archeology, and surviving architecture have revealed the Byzantines' considerable knowledge and command of math, physics, and optics. This knowledge challenges the older notions of the limited role of architects in Byzantine society.

And this knowledge was not limited to Byzantium and its churches. The domed canopy-like structural skeleton of the fifteenth-century church of Santa Maria delle Carceri at Prato embodies the essence of this church design. It was among the first to use a Greek-cross plan in the Italian Renaissance.

Although little is known about Byzantine architectural practices, the presence of Greek intellectuals and the construction of Byzantine churches in Italy points to possible historical, cultural, and intellectual connections that have been reinforced by the shared Byzantine and Renaissance design of centrally-planned churches. In that light, the Greek-cross plan of Renaissance centralized churches may be related to Byzantine

experimentations with church design based on a modular integration of a canopied dome into the nine-square grid.

My research shows that Byzantine design was never done without considering plasticity and interiority. This is perhaps the major reason for the scarcity of Byzantine architectural drawings showing recognizable floor plans, which one can easily recover using modern architectural principles of design and representation.

The Memorable Hagia Sophia

Indeed, the memorable Hagia Sophia—its massive interior framed by the dome that rests on four clustered piers—marks Byzantine architecture with its iconicity, plasticity, interiority, and experiential qualities. The impressive domed canopy set on a nine-square grid would seem to expose the potential of the architectural *parti* of the Byzantine church, and yet it is the non-imitative qualities and diversity of design solutions of Byzantine imperial architecture that elucidate its complexity and sophistication.

Even though and perhaps because it was never exactly duplicated, the design of the Hagia Sophia and the recurrent, emphatic experiences of its central core as a "cloud of light on a pillar" evoking divine presence, allowed for systemic architectural design. Experimentation with the plastic treatment of typological solutions based on the canopied dome set on a nine-square grid was inseparable from the material and immaterial aspects of the Byzantine church.

Such a systemic design, though simple in its nature, was highly generative and can be observed in various Byzantine-rite and Byzantine-inspired churches. The eleventh-century Venetian cathedral of San Marco's Basilica, the twelfth-century churches in the Constantinopolitan urban monastery of Christ Pantokrator and the medieval rural monastery of Studenica in Serbia, or the early twentieth-century Church of All Saints in Stuart, Iowa, exemplify the power of the Byzantine domed church to transcend its own geography and time.

These structures show how Byzantine architecture reinvented itself in larger networks of diverse cultural contexts and established itself as a self-sufficient architectural and spiritual stronghold. It is an architecture with an authority that rests on the balance between iconicity and plasticity, here elucidated through the dynamics of architectural design. It highlights the capacity of Byzantine design practices to create architecture that is non-invasive but strongly present, non-imitative but reproducible, spiritual but non-illusionistic, and monumental but humane.

With help and drawings by Alexander Blum, Madeleine Loyd, Nicole Hoke, and Heidi Reburn

Jelena Bogdanović is the author of The Framing of Sacred Space: The Canopy and the Byzantine Church.

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